CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

Environmental Management and Sustainability Program Innovation Initiative

Environmental Management System Project
Report to the Legislature:
Final Report
SEPTEMBER 10, 2002

DRAFT FINAL

Winston Hickox, Secretary
California Environmental Protection Agency

Table of Contents

Appendix J: Public Resource Code 71045(Assembly Bill 1102)

Cal/EPA Environmental Management System Project
Report to the Legislature:
Executive Summary

I. Background

The quest for a sustainable world began two decades ago with the work of the *United Nations World Commission on Environment and Development*. The Commission's report "Our Common Future", published in 1987, identified worldwide pressures and proposed actions that would foster sustainable development. Then in 1992, 172 nations participated in *The United Nations Conference on Environment and Development* in Rio de Janeiro, Brazil. Significantly, one result of the conference was the adoption of a comprehensive set of guidelines, Agenda 21, for achieving a sustainable global environment. Another result of the conference was the international business community's support for the development of standardized management systems for environmental protection. By 1996, the International Organization for Standardization (ISO) developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises.

In 1998, the California Environmental Protection Agency (Cal/EPA) established an *Innovation Initiative* as a response to the growing international interest in achieving a sustainable global environment. It joined with U.S. EPA, non- governmental organizations (NGOs), business, academia and other states as a member of the Multi-State Working Group (MSWG) to study the environmental benefits of EMS as a tool for enhancing environmental protection and achieving sustainable development. The MSWG participants and observers presently include all 50 states, several of which are actively engaged in approximately 50 EMS pilot projects.

Because of the significant policy implications of the *Innovation Initiative*, the Legislature authorized the Cal/EPA to establish up to eight pilot projects with which to evaluate the potential of EMS in California. This executive summary describes the findings, conclusions, and recommendations resulting from the *Environmental Management System Project* (EMS Pilot Project) as prescribed in Assembly Bill 1102 (Stats. 1999, Ch. 65) codified in Public Resources Code (PRC), Section 71045 et seq. (AB 1102).

II. Pilot Project Goal

The EMS Pilot Project goal is to evaluate the EMS potential to achieve environmental results within and beyond the limitations of the existing regulatory system.

III. Pilot Project Objectives

The objectives of the EMS Pilot Project as specified by law are to evaluate:

1. Whether and how the use of an environmental management system (EMS) by a regulated entity increases public health and environmental protection over the present regulatory system and;
2. Whether and how the use of an EMS provides the public greater information on the nature and extent of public health and environmental effects than information provided by the present regulatory system.

To the above, Cal/EPA added the following objectives:

3. Evaluate economic indicators to determine incentives and barriers to EMS implementation.
4. Identify challenges and successful examples of EMS implementation.

Each of the pilot projects may identify additional project specific objectives that characterize unique aspects of a pilot's EMS.

IV. What is an EMS?

Stated simply, an environmental management system (EMS) is a management process designed to help an organization meet environmental objectives and achieve and demonstrate improved environmental performance. An EMS provides a systems framework for a process that includes a continuous cycle of planning, implementing, reviewing, and improving. The Plan-Do-Check-Act (or Adjust) cycle broadly outlines the systems approach of an EMS. The elements of an EMS include the environmental policy; aspects and impacts; objectives and targets; management programs; operational control; audits; management review; preventative and corrective action; communication networks; people and technology.

There are several models for EMSs; however, in 1996 the International Organization for Standardization (ISO) developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. ISO 14001 is a voluntary, global standard for environmental management systems. ISO means "equal" and represents the International Organization for Standardization, a non-governmental international organization based in Geneva, Switzerland. In the United States, organizations can elect to be certified (registered) to the ISO 14001 Standard by an independent auditor registered by the American National Standards Institute Registration Accreditation Board (ANSI RAB). It is important to understand that ISO 14001 certification is given to the *process* not the results. Process improvements are assumed to lead to better environmental performance results, such as improved compliance or the conservation of resources. This assumption is tested in the Cal/EPA EMS Pilot Project.

V. Project Design and Methodology

A multi-disciplinary team, administered through the Office of the Secretary, managed the EMS Pilot Project. Team members from the Air Resources Board, Department of

Toxic Substances Control, Integrated Waste Management Board, and State Water Resources Control Board served as project managers for the pilot projects.

Phase I –Pilot Project Development

Phase I of the project consisted of identifying and soliciting stakeholders, including business, government and non-governmental organizations, to assist in the design of the project, the criteria by which pilots would be selected, data collection protocols, and Pilot Project Work Plans. Two Working Groups, one in Northern California and one in Southern California, were established in 1999. Also, Local Working Groups for individual pilot projects were encouraged. Several workshops were conducted to involve stakeholders directly in the development of pilot project selection criteria, Pilot Project Work Plans, and Evaluation and Monitoring Parameters (data collection protocols).[1] Two public hearings were conducted in May 2000 and the following seven pilot projects were selected.

- Anheuser-Busch Brewery, Fairfield (A-BI)
- Two publicly owned wastewater treatment facilities: Central Marin Sanitation Agency in San Rafael (CMSA); San Diego Metropolitan Wastewater Department, Operations and Maintenance Division, San Diego (San Diego)
- IBM Corporation, San Jose (IBM)
- Lockheed Martin Aeronautics Company, Palmdale (LM Aero - Palmdale)
- Two metal finishing facilities: Artistic Plating, Anaheim (Artistic); Gene's Plating, Los Angeles (later removed from the project)
- Pentel of America, Ltd., Torrance (Pentel)
- Two Sonoma County wineries: Davis Bynum Winery; Benziger Family Winery (wineries)

Phase II – Data Collection, EMS Education

The second phase of the pilot project involved collecting data on EMS implementation from pilot projects using the Evaluation and Monitoring Parameters as well as facility visits. A series of four educational workshops given in both Northern and Southern California and funded by a US EPA grant were developed to provide a basic understanding of EMSs for all stakeholders. Developing a common understanding was a critical prerequisite to evaluating data and establishing the conclusions of the EMS project.

[1] Evaluation and Monitoring Parameters and Working Group meeting minutes are available at www.calepa.ca.gov/EMS.

Evaluation and Monitoring Parameters selected for the EMS Project consist of the National Database on Environmental Management Systems Data Protocols (National Database) and the Supplemental California Protocols. The National Database was developed by the Multi-State Working Group on EMS and funded by the US EPA.

Phase III – Data Analysis

The final phase of the EMS Project involved an analysis of the data and establishing the conclusions of the project. The evaluation of each pilot project is described in pilot study reports (Appendices A through H). Data analysis is conducted based on a specified methodology and supports determinations as to whether and how the use of an EMS:

- Increases public health and environmental protection[2] beyond that required by law and regulation; and
- Provides the public with greater environmental information than required by law and regulation.

To determine whether and how improved environmental protection resulted from EMS implementation, Cal/EPA evaluated three primary categories of information from each pilot project, these being improvements in: 1) awareness and commitment; 2) systematic management of environmental impacts; and 3) performance for key environmental indicators.

The provision of greater environmental information was measured by evaluating the type, relevance, and accessibility of the information. The level of involvement the receiving audience has in the information's creation can also indicate greater information. Therefore Cal/EPA analyzed: 1) public access to information about the EMS, environmental impacts and environmental performance; and 2) public and stakeholder involvement in EMS development, implementation and review.

Pilot study analysis also supports the formation of findings and conclusions related to economic impacts of EMS implementation, challenges and successes in EMS implementation, and any specific objectives identified in the individual Pilot Project Work Plans.

VI. Project Description Summaries

The Legislative Report includes summaries of each pilot project. Pilot study Reports are included in Appendices A through H.

[2] This report and the pilot study reports use the term environmental protection to mean both environmental and public health protection.

VII. Findings

This section provides findings based on the results and analysis of the individual EMS pilot projects, separated into four categories. The first two categories address the main objectives of the Cal/EPA EMS Project and are related to improved environmental protection and greater public information. A third category addresses economic findings. The final category addresses lessons learned including challenges to and successes of EMS implementation.

A. Findings related to whether and how an EMS increases public health and environmental protection beyond that required by law and regulation.

Significant improvements in environmental protection were observed in most of the pilot projects. Pilots demonstrated increased awareness of their environmental impacts and responsibilities through aspect and impact assessment and through the identification of legal and other requirements. Their Environmental Policies and objectives and targets established greater commitments to environmental protection than was observed prior to EMS implementation. These changes established a basis for further system changes and improved performance.

Improved systems for managing environmental impacts were observed in many of the pilot projects. System elements that were found to improve environmental protection include increased monitoring and measurement, operational controls, communication, training and job responsibilities. Systems for compliance assurance included some or all of the following elements: improved monitoring, internal and external audits, management review, root cause analysis, corrective action, and preventive action. Pilot projects with mature EMSs created systems for continual improvement that included performance measurement, internal and external audits, management review, corrective action, and new objective setting. Information technology played an important role in implementing, maintaining, and improving EMSs at the larger facilities with mature EMSs.

Some improvement in environmental performance was observed at all pilots reporting performance data. The range of improvement, however, varied between pilots, with some reporting significant change (Artistic, LM Aero, Pentel, and San Diego) while others reported only moderate gains (A-BI and IBM). The vast majority of performance improvements were observed in non-regulated areas. With the exception of pollution prevention goals for hazardous waste and toxic releases, objectives and targets were more likely set for non-regulated media.

Barriers or thresholds to environmental performance were observed in many pilot projects. In some cases, regulatory emission limits acted as a limit to improved environmental performance.

Compliance improvements were difficult to observe, as measured by violations; however, many pilots had a better recognition of and response to compliance issues. In

some cases, pilots who had no violations before the EMS was put in place, such as IBM, continued to have no violations afterwards. In other cases, pilots who had violations before the EMS, such as Artistic, had some violations after the EMS was put in place, but had better systems in place to respond to problems swiftly.

B. Findings related to whether and how an EMS provides greater environmental information to the public than that required by law and regulation.

New and useful environmental information can be created through the implementation of EMSs. This includes environmental policies, lists of significant impacts, objectives for improvement, and performance indicators. With the exception of some performance indicators, laws and regulations do not require this information be created. However, EMS implementation did not result in great improvements in the availability and access of environmental information to the general public. Pilot projects willingly shared EMS information within the Cal/EPA sponsored Working Groups. Most pilots only make this same information available to the general public upon request.

The level of stakeholder involvement is another measure of improved information. Direct government involvement through the Merit Partnership and Strategic Goals Program improved the quality of the metal finishing EMS by helping to identify impacts and set meaningful objectives and targets. Cal/EPA's involvement in the development of the wineries' EMS also influenced their development. Local stakeholder groups were present at three pilots (CMSA, Wineries, and LM Aero – Palmdale). More focused stakeholder participation and input into EMSs occurred in Local Working Groups as compared to the Regional Working Groups.

C. Economic Indicators

Only two pilot projects reported economic data. As a result of environmental improvements in its manufacturing processes, Artistic Plating is projected to realize a $1,028,960 saving over a 10-year period. LM Aero – Palmdale has reduced its annual environmental costs by over $1 million (or 54%) between 1992 and 1999. Total cost savings during that period equal $7,249,000. Although economic data may not be generally available, several pilots reported cost savings as a result of EMS implementation (Pentel, San Diego, IBM, and A-BI).

D. Challenges to and Successes of EMS implementation

The presence of a champion and senior management support were seen as critical to successful EMS implementation. When these conditions were not present, pilots experienced difficulty implementing their EMS.

EMS implementation can be especially challenging to small and medium sized enterprises (SMEs). One challenge is the significant economic and human resources needed to develop, implement and maintain an EMS. Because of the many changing responsibilities of employees and management at an SME, maintaining focus and momentum can be challenging. The technical complexity of an EMS is another

challenge. Technical assistance from government helped overcome economic and technical barriers to EMS implementation at the pilots considered SMEs.

The pilot projects also demonstrated examples of successful EMS implementation. Pilots with fully implemented EMSs, like LM Aero – Palmdale, IBM, A-BI, Pentel and San Diego were able to successfully connect the different elements of their EMS into a consistent and integrated system. Pilots with mature EMSs were also able to integrate their EMSs into the various aspects of their business including design, production, and purchasing. On the contrary, pilots with EMSs still in development or partially implemented (CMSA, Wineries) have not been able to thoroughly connect various elements of their EMS. Limited performance improvements were observed at these pilots.

VIII. Analysis

The analysis section is based on the findings of the pilot project and provides a synthesis of that information in order to understand how an EMS can provide improved environmental protection.

The Value of a Systems Approach

EMS implementation can have a positive effect on environmental protection including improved systems for environmental compliance. The systems approach to environmental management used in an EMS is key to this success. The Plan-Do-Check-Act (or Adjust) cycle broadly outlines the systems approach of an EMS. This cycle establishes a feedback loop that helps drive continual improvement in environmental protection.

Factors That Affect the Quality of an EMS

A range of environmental performance outcomes, or protection improvements, was observed in the EMS pilot projects. Cal/EPA observed several factors that either act to inhibit or promote successful EMS implementation as measured by the resulting improvements in environmental protection. For example, promoters include a strong management commitment to EMS implementation and improved environmental protection, as well as the presence of champions in either management or staff. Inhibitors include a lack of financial or personnel resources to develop and implement an EMS. (See Table 5 for more examples.)

Improvements in Environmental Protection

Theoretically, improvement in environmental protection can be graphically represented by an ‘S’ curve. During the early stages of EMS development and implementation, an organization must overcome challenges that act to inhibit the system’s development and impact the resulting level of environmental protection. As these challenges are overcome and the system is implemented, environmental protection advances. Improvements will continue until barriers for continued improvement, or thresholds of

the system are reached. Once a threshold is reached three scenarios are possible. Performance stagnates, breaks through the barrier and continues to improve, or backslides.

IX. Conclusions

1. EMSs Can Have a Positive Impact on Environmental Protection

Most pilot projects improved environmental protection in areas of significant environmental impact that are not addressed by regulation or law. Very few pilots, on the other hand, outperformed legally mandated performance levels, such as discharge limits, as a result of EMS implementation. However, EMSs were responsible for improved compliance with regulatory standards at pilots such as LM Aero - Palmdale and Pentel.

2. A Systems Approach Towards Environmental Management Yields Results

Part of the primary objective of the EMS Pilot Project was to determine how an EMS improves environmental protection. EMSs can improve environmental protection at an organization by taking a Systems Approach. Critical to the operation of a system and the achievement of goals is the movement of information through feedback loops. Feedback and corrective action can result in the continual improvement of environmental protection.

3. Organizations May be Reluctant to Set Objectives and Targets that Exceed Regulatory Standards

Quantitative regulatory emission, discharge, and reporting standards can act as a ceiling for environmental performance if an organization is not motivated to perform beyond regulatory requirements by other benefits, economic or civic.

4. Economic Benefits May Motivate Improvements in Non-Regulated Activities

Although limited economic information was collected in the EMS Pilot Project, economic benefits were reported from the conservation of electricity and water and the reduction of solid and hazardous waste disposed.

5. Better Understanding of EMS is Needed at All Levels of Government

Since environmental performance can be enhanced through the use of EMSs, government at all levels will need to understand EMSs and their use as a tool to better environmental performance.

6. Government Support of EMSs Could Improve Environmental Protection

Government can support EMS development and improve environmental protection by providing tools such as templates or implementation guides; providing grants; establishing partnerships; establishing performance goals; providing rewards (such as

public recognition) for outstanding organizations; providing resources; and supporting EMS development for Supplemental Environmental Projects in enforcement cases.

7. EMSs Generate New and Useful Environmental Information

The systems approach to environmental management found in EMSs generates new and useful information. Information flow acts as a feedback loop allowing the system to adjust in order to stay consistent with the environmental policy and meet objectives. The types of information created by an EMS include: environmental policy; significant environmental aspects and impacts; objectives and targets; performance metrics; programs and procedures; audit results; and preventative and corrective actions.

8. Potential for Improved Sharing of Environmental Information with the General Public not yet Realized.

Environmental information generated by a pilot's EMS is usually organized in ways that make the information relevant and accessible. However, this information is generally used for internal purposes, or made available to the public only on request. With the exception of the Cal/EPA sponsored stakeholder Working Groups, environmental performance information generated by the pilots was not usually shared with the general public. Several pilot projects use the Internet to provide the public with some environmental information, such as environmental policies.

9. EMS Information May Be Useful to External Parties and Help Improve Environmental Protection by Creating External Feedback Loops

The type of information generated by EMSs may be valuable to both environmental agencies and communities. Communities or non-governmental organizations could use the information to track environmental issues important to them and provide feedback to both regulatory agencies and to the organization with the EMS. Therefore, EMSs have the potential of establishing performance enhancing communication systems between industry, communities, and government.

10. Small and Medium Sized Enterprises (SMEs) May be Especially Challenged in Implementing EMSs

For a small or medium sized enterprise, there are many barriers to successful EMS implementation. These companies may face personnel and economic challenges in EMS implementation that are not issues for larger companies. SMEs may require assistance in overcoming barriers. Large, sophisticated organization could play a role in mentoring smaller organizations.

11. EMS Require a Foundation of Enforceable Standards

EMSs should not be viewed as an alternative or a replacement for the current command and control regulatory system. Enforceable standards are essential to environmental protection in California because they set the minimum level of performance. EMSs

provide a new tool that can help ensure greater adherence to regulatory standards as well as protection beyond legal mandates and in areas outside regulatory protection.

X. Recommendations

1. Establish and Nurture a Culture of Innovation and Experimentation within Cal/EPA

Cal/EPA can help to institutionalize the use of cross-media, multiple tool approaches to address persistent California-specific environmental problems. This can be accomplished through specific projects implemented through partnerships involving state, local, and federal agencies as well as industry representative and the non-government public interest sector.

Through implementing its own EMS, Cal/EPA can also learn about EMSs and set an example for others. This first hand experience with EMS implementation will help Cal/EPA understand the application of an EMS more thoroughly, and learn how it applies to a regulating agency.

Also, Cal/EPA can develop emerging leaders by informing and educating Cal/EPA management and professional staff about the range of policy, management, and technology tools available for environmental problem solving. This approach can help federal, state, and local governments develop the leadership ability to institutionalize more protective environmental and resource management policies and practices through education and practical application.

2. Government can set targets to increase environmental performance.

Environmental performance targets can establish sector, regional or statewide goals for greater environmental protection. Whether voluntary or legislatively mandated, targets can help spur performance improvement. Stakeholder partnerships might establish targets for a sector or region and then assist in providing the tools necessary for meeting those targets. Assistance could be in the form of EMS templates or other innovative technologies.

3. Government can support environmental information sharing with the public and recognize efforts to share information

EMSs provide an excellent structure for gathering information. Government can help make environmental information available to the public, such as information on environmental impacts, targets for improvement, and progress towards goals. Improved information sharing could be one criterion for public recognition of environmental efforts.

Government could explore developing a reporting approach for organizations with EMSs, which meet multiple agency requirements in a consolidated fashion. In this way,

government may request more environmental performance data, recognize accomplishments, and make reporting requirements more efficient.

4. Establish a Regulatory Track for High Environmental Performers

In order to maintain and increase environmental protection for the highest environmental performing organizations, a separate regulatory track should be created. In exchange for strict environmental compliance, superior environmental performance and increased public reporting, advanced legal relationships between the regulated and regulating agencies can be established. This, new approach could include facility wide permits, longer permit life, and more meaningful and modern reporting requirements.

5. Implement EMSs with Key Elements

For an organization to successfully implement systems based management of the environment, key elements must be present. Based on the information collected in the pilot project, Cal/EPA recommends the following key elements:

- An environmental policy with commitments to pollution prevention, resource conservation, compliance, public involvement and continual improvement;
- Whole system assessment of environmental impacts and identification of those which are most significant;
- Objective setting for the reduction of environmental impacts;
- Measuring and monitoring of practices and performance which support environmental policy and objectives;
- Operational controls;
- Audits (internal and third party);
- Management review and adjustments in the system to ensure continual improvement;
- Involvement of effective stakeholders; and
- Public reporting of performance results.

Cal/EPA Environmental Management System Project
Report to the Legislature:
Final Report

I. Background

The quest for a sustainable world has a brief but impressive history. It began just over two decades ago with the work of the *United Nations World Commission on Environment and Development*. The Commission's report "Our Common Future", published in 1987, identified worldwide pressures and proposed actions that would foster sustainable development. Then in 1992, 172 nations participated in *The United Nations Conference on Environment and Development* in Rio de Janeiro, Brazil. Significantly, one result of the conference was the adoption of a comprehensive set of guidelines, Agenda 21, for achieving a sustainable global environment. Another result of the conference was the international business community's support for the development of standardized management systems for environmental protection. By 1996, the International Organization for Standardization (ISO) developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises.

In 1998, the California Environmental Protection Agency (Cal/EPA) established an *Innovation Initiative* as a response to the growing international interest in achieving a sustainable global environment. It joined with U.S. EPA, non governmental organizations (NGOs), business, academia and other states as a member of the Multi-State Working Group (MSWG) to study the environmental benefits of EMS as a tool for enhancing environmental protection and achieving sustainable development. The MSWG participants and observers presently include all 50 states, several of which are actively engaged in approximately 50 EMS pilot projects.

Because of the significant policy implications of the *Innovation Initiative*, the Legislature authorized the Cal/EPA to establish up to eight pilot projects with which to evaluate the potential of EMS in California. This report describes the findings and recommendations resulting from the *Environmental Management System Project* (EMS Pilot Project) as prescribed in AB 1102 (Stats. 1999, Ch. 65) Public Resources Code (PRC), Section 71045 et seq.

New Approaches to Environmental Protection are Needed

The job of protecting human health and the environment is never done. What we know about the environment today – even our knowledge of the questions still to be answered – is vastly greater than what we knew only a decade ago. This knowledge provides ever-increasing evidence of the sensitivity of the environment and human health to the impacts of pollution and the inefficient use of resources.

California has one of the most successful "command and control" environmental protection systems in the world.[3] It has served the State well. Progress toward protecting public health and the environment has been dramatic since the passage of the first environmental laws over thirty years ago. Fair, firm, and consistent enforcement of environmental laws is still, and will continue to be, a cornerstone of environmental protection in California.

California has long been a pioneer in taking the initiative to reduce environmental risks posed by air, water, toxic and solid waste pollution. It must now continue this pioneering tradition by building a cross-media perspective into environmental protection programs and motivate industries to use and conserve resources wisely. Otherwise, the ability to sustain let alone improve the quality of life for Californians will be severely limited.

Consider the following stresses on the quality of our environment:

- California's current population of 34.6 million is expected to increase by 70%, to 58.8 million, by 2040.[4]
- Eighty-five percent of the energy used in California is generated from petroleum products, a major source of emissions that contribute to global warming and depletion of oil reserves.[5]
- Vehicle miles traveled will almost double by 2020.[6]
- Since 1986 over 500 chemicals in use in California have been determined to cause cancer or reproductive toxicity.[7]
- The gasoline additive MTBE has been detected in 62 drinking water sources. Several communities have lost their source water as a result.[8]

These facts are but a sample of the pressures we are placing on our quality of life and natural resources. It is clear that there is much more to be done to address these and other environmental and resource management challenges.

Among the options for addressing these challenges is a more holistic approach to managing our businesses and industries – an approach that serves both quality of life

[3] Within the context of environmental protection, the term "command and control" is used to describe regulating pollution at the point of discharge by setting limits on how much pollution will be tolerated. Hence we "command" a maximum acceptable limit and "control" pollution at the point of discharge.
[4] State of California, Department of Finance, *County Population Projections with Race/Ethnic Detail*, 2000
[5] California Energy Commission, *California Energy Facts*, August 1998
[6] California Department of Transportation, Transportation System Information Program, *California Motor Vehicle Stock, Travel and Fuel Forecast*, November 1997
[7] State of California, Office of Environmental Health Hazard Assessment, *Chemicals known to the State to Cause Cancer or Reproductive Toxicity*, Internet posting, March 10, 2000
[8] California Department of Health Services, Drinking Water Quality Database, 2000

and economic values. Many corporations are seeking more cost-effective ways to meet regulatory requirements, and some leading corporations are recognizing environmental protection as part of their mission and image. NGOs and local communities want a cleaner and safer environment, and are striving to ensure that environmental information is available to them and their voices are heard. The EMS approach to environmental protection shows considerable promise as a tool for meeting these objectives.

II. Pilot Project Goal

The EMS Pilot Project goal is to evaluate the EMS potential to achieve environmental results within and beyond the limitations of the existing regulatory system.

III. Pilot Project Objectives

The objectives of the EMS Pilot Project as specified by law are to evaluate:

1. Whether and how the use of an environmental management system (EMS) by a regulated entity increases public health and environmental protection over the present regulatory system and;
2. Whether and how the use of an EMS provides the public greater information on the nature and extent of public health and environmental effects than information provided by the present regulatory system.

To the above, Cal/EPA added the following objectives:

3. Evaluate economic indicators to determine incentives and barriers to EMS implementation.

4. Identify challenges and successful examples of EMS implementation.

Each of the pilot projects may may have identified additional project-specific objectives that characterize unique aspects of a pilot's EMS.

IV. What is an EMS?

Stated simply, an environmental management system (EMS) is a management process designed to help an organization meet environmental objectives and achieve and demonstrate improved environmental performance. In theory, an EMS employs a systems approach[9] to environmental management by providing a systematic review of a

[9] An accepted definition of a system is "a set of elements in dynamic interaction, organized for a common goal." Through the implementation of an EMS, an organization operates a system with the goal of improved environmental protection.

company's operations to identify opportunities and create practices for more efficient use of raw materials and resources, maintain regulatory compliance, and to identify and manage or lessen the environmental impacts of operations. It is a process of continual improvement, and as such results must be monitored and reported frequently to determine the effectiveness of the process and the need for system adjustments to promote continued improvement. Understanding the actual practice of EMS implementation and its ability to better protect the environment is the purpose of the Cal/EPA EMS Pilot Project.

There are several models for EMSs; however, in 1996 the International Organization for Standardization (ISO) developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. ISO 14001 is a voluntary, global standard for environmental management systems. ISO means "equal" and represents the International Organization for Standardization, a non-governmental international organization based in Geneva, Switzerland. In the United States, organizations can elect to be certified (registered) to the ISO 14001 Standard by an independent auditor registered by the American National Standards Institute Registration Accreditation Board (ANSI RAB).

From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises. It is important to understand that ISO 14001 certification is given to the *process* not the results. Results must be measured and evaluated externally by regulators for compliance and internally by management for other environmental objectives such as resource use efficiencies. The ISO 14001 Standard however, requires that the organization's processes for environmental protection continually improves. Process improvements are assumed to lead to better environmental performance results, such as improved compliance or the conservation of resources. This assumption is tested in the Cal/EPA EMS Pilot Project. The continual improvement nature of an EMS may create a nexus between the EMS process, the regulatory system, and the long-term environmental societal goal of an improving environment.

An EMS provides a systems framework for a process that includes a continuous cycle of planning, implementing, reviewing, and improving the actions an organization takes to meet its business objectives and environmental obligations. The Plan-Do-Check-Act (or Adjust) cycle broadly outlines the systems approach of an EMSs. This cycle establishes a feedback loop that helps drive continual improvement in environmental protection. As shown in Figure 1 below, a continual improvement cycle is established through this process.

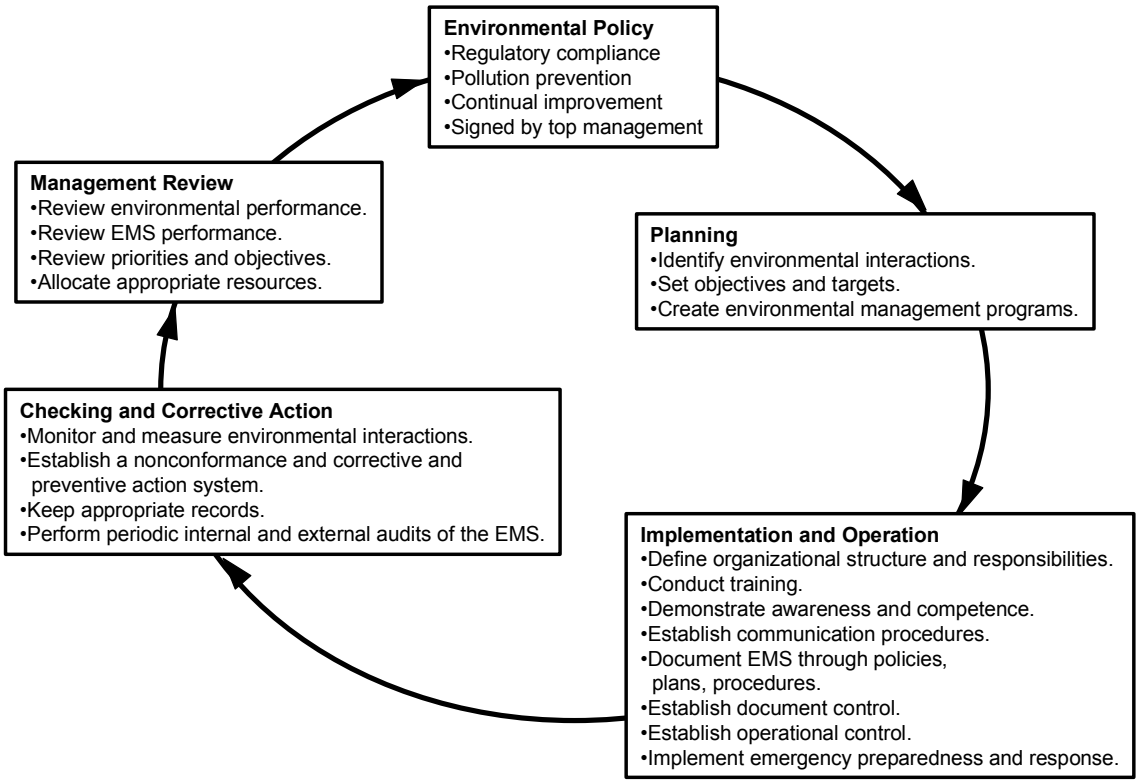

Figure 1: EMS Continual Improvement Process

V. Project Design and Methodology

This section describes the requirements and elements of project design as well as methodology for implementing pilot projects, collecting data, analyzing data and establishing conclusions.

A multi-disciplinary team, administered through the Office of the Secretary, managed the EMS Pilot Project. Team members, from the Air Resources Board, Department of Toxic Substances Control, Integrated Waste Management Board, and State Water Resources Control Board, served as project managers for the pilot projects.

Phase I –Pilot Project Development

Phase I of the project consisted of identifying and soliciting stakeholders, including business, government and non-governmental organizations, to assist in the design of the Project, the criteria by which pilots would be selected, data collection protocols, and Pilot Project Work Plans. This phase concluded with two public hearings in May 2000 and the selection of seven pilot projects.

Selection of pilot projects was based on the following selection criteria:

- Pilot projects will have an ongoing or planned EMS that can reasonably be expected to produce greater environmental protection than would otherwise be achieved by the existing regulatory process.
- Pilot projects will engage in a multi-media environmental approach (e.g., air, water, solid and hazardous waste).
- Pilot projects will pursue appropriate pollution and waste prevention opportunities.
- Pilot projects will share information learned from EMS implementation with Cal/EPA, regional and/or local working groups, and the public. Pilot projects agree to provide specific data on the goals, implementation, and performance of their EMS as reported in the national and California supplemental data protocols.
- Pilot projects will participate on the Northern or Southern California EMS Working Group.
- Pilot projects will declare to Cal/EPA any current and past (three years) violations cited by environmental regulatory agencies.
- Pilot projects will address known regulatory deficiencies, as required by the appropriate regulatory agency, through their EMS.
- Pilot projects' top management will make a full commitment to participate in the project through a letter of intent.
- Pilot projects will represent diversity in terms of location/geography, size, industry type or sector, environmental impacts, and in the range of EMS maturity.

Meetings with stakeholders began in 1998, prior to the present pilot project, and sought to define how best to involve interested individuals, communities, organizations, academics, business and government. Based on stakeholder recommendations, two Working Groups, one in Northern California and one in Southern California were established in 1999. Also, Local Working Groups for individual pilot projects were encouraged. Several workshops were conducted to involve stakeholders directly in the development of pilot project selection criteria, pilot project work plans, and evaluation and monitoring parameters (data collection protocols). [10]

Cal/EPA also consulted with the boards, departments and offices within Cal/EPA, other interested state, regional and local agencies and other interested parties. Consultation with these entities took place through briefings to executive staff, regular and electronic

[10] Evaluation and Monitoring Parameters and Working Group meeting minutes are available at www.calepa.ca.gov/EMS.

mailings of public notices and draft documents, and inclusion of state, and regional and local agencies within the stakeholder working groups. Prior to selecting the pilot projects, state, regional and local environmental enforcement agencies were contacted to determine compliance history of the project candidates.

In addition to the stakeholder workshops, Cal/EPA conducted two publically noticed hearings in May 2000, one in Southern California and one in Northern California.

After completion of the public involvement process, Cal/EPA selected the following seven pilot projects in June 2000.

- Anheuser-Busch Brewery, Fairfield (A-BI)
- Two publicly owned wastewater treatment facilities: Central Marin Sanitation Agency in San Rafael (CMSA); San Diego Metropolitan Wastewater Department, Operations and Maintenance Division, San Diego
- IBM Corporation, San Jose (IBM)
- Lockheed Martin Aeronautics Company, Palmdale (LM Aero – Palmdale)
- Two metal finishing facilities: Artistic Plating, Anaheim (Artistic); Gene's Plating, Los Angeles (later removed from the project)
- Pentel of America, Ltd., Torrance (Pentel)
- Two Sonoma County wineries: Davis Bynum Winery; Benziger Family Winery (Wineries)

Following the public hearings, Cal/EPA established Evaluation and Monitoring Parameters and a Model Pilot Project Work Plan. Each pilot project completed a Work Plan based on the model. The Pilot Project Work Plans set project objectives and roles and responsibilities for each pilot organization and Cal/EPA. Evaluation and Monitoring Parameters were the basis for data collection and will be discussed in the next section.

Phase II – Data Collection, EMS Education

The second phase of the pilot project involved collecting data from pilot projects on EMS implementation using the Evaluation and Monitoring Parameters as well as facility visits. Because the understanding of the EMS technology varied amongst pilot projects, stakeholders, and Cal/EPA, establishing a basic understanding of EMS was another objective of this phase. This objective was accomplished through a series of four educational workshops given both in Southern and Northern California and funded by a US EPA grant. Workshop agendas included hands-on exercises and discussions on the design and implementation of an EMS, auditing, and public policy issues. Developing a common understanding was a critical prerequisite to evaluating data and establishing the conclusions of the EMS project.

Evaluation and Monitoring Parameters selected for the EMS Project consist of the National Database on Environmental Management Systems Data Protocols (National Database) administered by the University of North Carolina and the Supplemental California Protocols. The National Database was developed by the Multi-State Working Group on EMS and funded by the US EPA. The Database is used to collect standardized information on EMSs from pilot projects all over the United States. Because of the specific information requirements of AB 1102 (Stats. 1999, Ch. 65), PRC § 71045 et. seq. , Cal/EPA created supplemental data protocols to be used only in the California pilot projects. Each of these Evaluation and Monitoring Parameters is described in more detail below.

The National Database is a primary data set for the Cal/EPA EMS Pilot Project. Information was collected using three protocols: baseline, design and update. Baseline environmental conditions were established through the use of the National Data Baseline Protocols. These protocols required three years of pre-EMS environmental performance data as well as information on pre-EMS conditions in the following areas.

- Management Systems
- Environmental Performance
- Compliance
- Pollution Prevention
- Interested Party Involvement
- Economic Performance.

Information on the design of the pilots' EMS was collected using the National Database Design Protocol and provided the following information:

- Rationale for adopting an EMS
- Corporate-Facility EMS Relationships
- Process for developing Environmental Policy
- Environmental Aspects and Impacts
- Objectives and Targets
- Supply Chain Relationships
- EMS Structure and Responsibility
- Training
- Monitoring and Measurement of Regulatory Compliance
- EMS Audits

- Management Review
- ISO 14001 Certification
- Cost of EMS Design

In order to measure the effect of EMS implementation on the pilot projects' environmental performance and management, eighteen months of post-EMS data were collected using the National Database Update Protocols. The update protocols revisit each of the data categories collected in the baseline and design protocols.

The supplemental California Protocols were created to address specific data needs of the Cal/EPA EMS Project not addressed by the National Database. A primary purpose of the California Protocols was to answer whether and how an EMS provides greater environmental information to the public than that provided by the current regulatory system. The California Protocols also sought information on whether and how pilot EMSs met or exceeded environmental regulatory requirements. Each pilot project was asked specific questions in the following areas:

- Emergency Preparedness
- Environmental Performance
- Pollution Prevention
- Continual Improvement
- Employee Involvement
- Regulatory Innovation
- Supply Chain
- Quantity of Information
- Negative Consequences of an EMS

Data collection and EMS education were also accomplished through stakeholder site visits at each of the pilot project facilities. These on-site Working Group meetings facilitated dialogue between pilot project participants, Cal/EPA and stakeholders regarding pilot facility EMS design and implementation. During these meetings, pilot organizations shared information on EMS implementation, led a facility tour, answered questions, and received feedback from stakeholders on their EMS design and implementation. The following table shows the schedule for pilot facility visits.

Table 1
Site Visit Schedule

September 2000	Artistic Plating and IBM
November 2000	Benziger Family Winery
January 2001	Lockheed Martin Aero – Palmdale
March 2001	Central Marin Sanitation Agency
April 2001	Davis Bynum Winery
April 2001	San Diego Metropolitan Wastewater Department Operating and Maintenance Division
May 2001	Pentel of America, Limited
May 2001	Anheuser-Busch, Inc.

Phase III – Data Analysis

The final phase of the EMS Project involved an analysis of the data, findings and conclusions for each of the pilots, and establishing the overall conclusions of the project. Each pilot project is described in Appendices A through H. Data analysis is conducted based on methodology described below and supports determinations as to whether and how the use of an EMS:

- Increases pubic health and environmental protection beyond that required by law and regulation; and
- Provides the public with greater environmental information than required by law and regulation.

The above two statements paraphrase AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq. This report and the pilot study reports use the term environmental protection to mean both environmental and public health protection.

This section also describes methodology which supports the formation of findings and conclusions related to economic impacts of EMS implementation, challenges and successes in EMS implementation, and any specific objectives identified in the individual Pilot Project Work Plans.

Methods for Determining Increased Environmental Protection

To determine whether and how improved environmental protection resulted from EMS implementation, Cal/EPA evaluated three primary categories of information from each pilot project:

1. Awareness and Commitment
2. Systematic Management of Environmental Impacts
3. Performance for Key Environmental Indicators.

While each of the above categories may indicate improvements in environmental protection, they each provide different types of information, and when taken as a whole, support the conclusions made in this report and in the pilot project case studies.

Categories one and two qualitatively measure environmental protection and may be considered leading indicators of environmental protection in that they measure changes in attitude and behavior and not the resultant protection from those changes. Further, information collected in these first two categories helps explain how an EMS improves environmental protection.

Category three, performance of key environmental indicators, more directly and quantitatively measures actual results and changes in environmental protection. Examples of *key environmental indicators* are energy use, waste generation, and pollutant emissions. However, even these indicators often do not measure the resulting ecosystem effects such as reduced health risks, more fish in the stream, or less smog.

Ecosystem effects were outside the scope of indicators in the pilot project's EMS and are therefore not included in this study. The three indicator categories of environmental protection relate to each other like building blocks, each level becoming more refined, providing more quantitative information and together presenting a picture of the level of environmental protection provided by an EMS

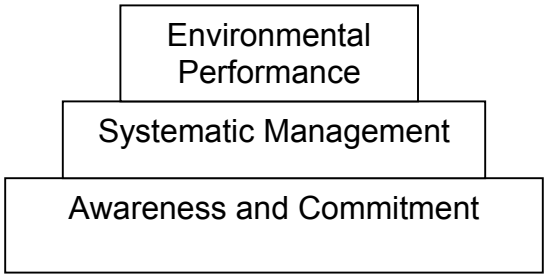

Figure 2: Building Blocks of Environmental Protection Indicator Categories

Awareness and Commitment refers to the scope of environmental issues to which the organization devotes its attention, identifies increased knowledge and understanding of environmental impacts, and recognition that action is necessary to lessen impacts and improve environmental protection. *Awareness and Commitment* is more a predictive and leading indicator of improved environmental protection than an actual measure. For example, an organization may become aware of an impact and commit to reducing its effect; however, the commitment has not yet been acted upon. Even so, measuring and understanding changes in *Awareness and Commitment* as a result of EMS implementation will help determine whether, and especially how, an EMS can improve

environmental protection. The following are measures of *Awareness and Commitment* and were analyzed for each pilot project:

- An environmental policy describing the organization's commitments and principles in regards to environmental protection.
- Demonstrated knowledge and understanding of environmental laws, regulations, and other requirements applying to their organization.
- Demonstrated knowledge and understanding of the environmental impacts (regulated and non-regulated) of the organization through the identification of aspects and impacts.
- Documentation of objectives and targets for environmental performance improvements and lessening negative environmental impacts.

The environmental policy of each pilot organization is presented and discussed in each pilot study. The evaluation of whether and how each pilot demonstrates knowledge of environmental requirements is based on Cal/EPA project manager's experience and knowledge of the pilot's EMS and data collected in the National Database. Knowledge and understanding of impacts is determined by analyzing significant aspects and impacts that are presented in Table 1 of the case studies. Objectives and Targets indicate environmental commitments. Table 2 of the case studies presents each pilot's objectives and targets, their status, and whether the target exceeds regulatory requirements. By evaluating an objective's status, we can determine what, if any, actions have been taken to meet that objective. Comparing the objective and target to regulatory requirements can identify commitments and/or achievements above and beyond regulatory requirements. This latter element of objective and target research begins to address the environmental performance of the pilot projects.

Table 2
Elements of an EMS that
Demonstrate Awareness and Commitment

EMS Element	Commitment	Awareness
Environmental Policy	X	X
Environmental Requirements		X
Aspects and Impacts	X	X
Objectives and Targets	X	

Systematic Management of Environmental Impacts refers to the ability of an organization to better protect the environment through a more mature and effective system of environmental management. Each pilot study report describes the important elements of the pilot project's EMS that provides greater environmental protection through implemented programs and procedures. By looking at the systems for

environmental management we can begin to understand not only 'whether' but also 'how' EMSs can provide greater environmental protection.

There are two key measures of a mature and effective system for public health and environmental protection. These are:

- Documented and implemented programs designed to meet regulatory requirements and achieve objectives and targets for environmental improvement; and
- Measures and review processes to assess both the management system and environmental performance and to make adjustments in order to continually improve both.

The programs designed to meet regulatory requirements and achieve objectives and targets are the core implementation elements and the 'do' portion of an EMS. These include operational control or communication programs that focus on impacts such as recycling, water conservation, chemical management, pollution prevention, or purchasing. The programs may also have a broader focus like training, emergency preparedness, compliance assurance or health and safety.

The second measures of *Systematic Management* are the 'check and act' processes in the EMS. These processes allow the organization to measure the effectiveness of their programs through the use of system audits and the measurement of performance data. A complete system will include the management review of audit findings and performance measures and result in adjustments and corrective actions thus ensuring the continual improvement of systems that provide environmental protection. Effective communication systems are critical for managing change and directing the organization towards environmental goals and improved environmental protection.

Each pilot study will analyze *Systematic Management* by evaluating data collected in the National Database and California Protocols (Evaluation and Monitoring Parameters)[11]. Information shared at the on-site Working Group meetings and other observations by the Cal/EPA project manager will contribute to this evaluation. This information will support conclusions as to whether the EMS implementation at the pilot facility has improved environmental protection over pre-EMS conditions and whether that protection meets or exceeds regulatory and legal requirements.

Key Environmental Indicators are the most quantitative and direct way of measuring changes in environmental protection. *Key Environmental Indicators* are the direct measures of performance of an EMS. Examples include energy use, water use, solid and hazardous waste reduction, air emissions, and quality of water discharge.

[11] Evaluation and Monitoring Parameters are available at www.calepa.ca.gov/EMS.

The National Database includes three years of baseline, or pre-EMS performance data and eighteen months of update, or post-EMS performance data. This data was used to identify changes in environmental performance that may be attributed to EMS implementation.

Table 3 in the pilot study reports presents both baseline (pre-EMS) and update (post-EMS) performance data for indicators specific and unique to each pilot project. Analyzing this data can indicate whether any improvements in environmental performance occurred after EMS implementation. Table 4 compares regulatory emission requirements with the actual emissions of the pilot. Again, pre and post EMS performance data is presented. This information can be used to determine whether performance (emissions) out performed regulatory requirements and whether performance improved after EMS implementation. Compliance data, including the frequency and type of violations, is another important indicator of environmental protection. Table 5 presents compliance history of the pilot before and after EMS implementation.

Methods for Determining Greater Environmental Information

The provision of greater environmental information can be measured by evaluating the type, relevance, and accessibility of the information. Two indicators are germane to this determination:

- Public access to information about the EMS, environmental impacts an d environmental performance.
- Public and stakeholder involvement in EMS development, implementation and review.

Data on the first indicator was collected using the Supplemental California Protocol. Table 6 of each pilot study reports the information topic, whether the information must legally be reported, and the location of the information. Legal reporting requirements establish the baseline, or minimum requirements for information sharing. Information sharing beyond legal requirements can indicate improvements in communication with the public. Improved compliance with legal requirements as a result of EMS implementation can also constitute an improvement in public information. The location of information indicates the availability of the information. Web site posting, for example, indicates wide distribution of information, while the public relations department or environmental agency can indicate that information is available only upon request.

The level of public and stakeholder involvement in the EMS development, implementation and review not only indicate greater communication, it also indicates a greater participatory role for stakeholders in improving environmental protection. Involvement provides avenues for stakeholder response to environmental information and feedback to the organization on their performance. This indicator of greater environmental information is measured by evaluating actual stakeholder participation in

the pilot's EMS and processes in the EMS for outside communication. This information was collected through the National Database, the Supplemental California Protocol and through Cal/EPA project managers' observations.

Methods for Determining Economic Impacts of EMS Implementation

In order to determine what economic impacts (costs/benefits) are associated with EMS implementation, data collected through the National Database is analyzed. Pre and post EMS costs are compared to establish cost savings or cost increases. Economic indicators can help answer how an EMS might improve environmental protection by identifying economic costs and benefits of EMS implementation that might act as barriers or incentives to greater protection.

For some pilots however, little or no economic data is reported in the National Database. Some pilots directly reported economic information to Cal/EPA. This information is primarily anecdotal and may only indicate trends or impressions of the pilot. Still other pilots have no economic information. For these pilots, the question of economic costs and benefits cannot be addressed.

Methods for Identifying Challenges and Successes of EMS Implementation

Lessons learned from the pilots' EMS experiences, challenges and successes were identified through Cal/EPA's Project Manager observations, interviews with personnel and data analysis. Understanding these challenges and successes help answer how an EMS might improve environmental protection.

Methods for Meeting Specific Project Objectives

Individual pilot projects may have project specific research objectives. These are identified in the pilot study reports along with specific methodologies to meet these objectives.

VI. Project Description Summaries

This section briefly describes the background, number of employees and the location of each pilot project. Complete case studies for each pilot can be found in Appendix B. The following table summarizes the development and ISO 14001 certification status of each pilot project.

Table 3
ISO Status of Pilot Projects

Pilot Project	Development	ISO 14001 Certification Status
Anheuser-Busch, Incorporated	Fully Implemented and Mature	Certified 1999
Artistic Plating	Recently Implemented	Not Certified
Central Marin Sanitation Agency	Early Design and Implementation	Not Certified
San Diego MWWD,	Recently Implemented	Certified 1999
IBM	Fully Implemented and Mature	Certified 1997
LM Aero – Palmdale	Fully Implemented and Mature	Self Declared Compliant 1998
Pentel of America	Recently Implemented	Certified 2001
Davis Bynum	Early Design and Implementation	Not Certified
Benziger Family Winery	Early Design and Implementation	Not Certified

Anheuser-Busch, Incorporated

Anheuser-Busch, Incorporated (A-BI) is a brewer of malt beverages. A-BI and its parent company, Anheuser-Busch Companies employ more than 24,000 employees in the United States and overseas and are headquartered in St. Louis, Missouri. Operations at A-BI's Fairfield, California facility include brewing, packaging, and distributing beer. The Fairfield facility has approximately 500 employees.

The Fairfield facility began development and implementation of its EMS as part of A-BI's company-wide initiative in 1992. Since 1992, A-BI progressively enhanced its EMS through a continual improvement process. The Fairfield facility was certified to ISO 14001 in December 1999. Further, the company's historical efforts to align its corporate Environmental Health & Safety (EHS) program with the ISO 14001 Standard provided an opportunity to assess the challenges of bridging from an EHS to a certified EMS. Because of the long history and evolution of environmental management at A-BI, their EMS is considered fully implemented and mature.

Metal Finishing Facilities

Artistic Plating Company

Artistic Plating Company (Artistic), located in Anaheim, California, is a medium-sized, metal finishing facility employing 129 individuals. The facility performs copper, nickel, brass, and chrome electroplating and specializes in electroplating zinc die-cast parts and aluminum wheels for commercial customers.

In June 1999, Artistic Plating Company volunteered to test the EMS template developed by U.S. EPA as part of the Merit Partnership Metal Finishing EMS (MFEMS) Template project. The MFEMS Template is based on ISO 14001, covering the elements of an EMS. The MFEMS Template does not include a section on operational controls, however. It is user friendly with tools to assist in implementing the different EMS elements and is tailored to the metal finishing industry. For example, it contains a tool designed specifically for a metal finishing facility to identify its environmental aspects. The template is designed to help a company create an EMS that could serve as an initial step towards ISO 14001 certification. Because systematic and comprehensive environmental management is new to Artistic, their EMS is considered recently implemented.

Gene's Plating (Removed From Cal/EPA EMS Pilot Project)

Gene's Plating is a metal finishing facility in Los Angeles, California. The facility performs copper, nickel, and chrome electroplating and various polishing operations. Cal/EPA selected Gene's Plating as a member of its metal finishing project after holding public hearings in May 2000.

At the end of November 2000, the Cal/EPA EMS Project Director learned about an enforcement referral to the Los Angeles City Attorney's office from the Department of Toxic Substances Control (DTSC). According to the referral letter, Gene's Plating was the subject of a joint investigation by DTSC and the Los Angeles County Fire Department in May 2000. Violations cited included possible illegal disposal of hazardous waste to the street, not minimizing the potential for a release of hazardous waste, which could threaten human health or the environment, and hazardous waste container/labeling mismanagement.

Based on the serious nature of the enforcement action and the lack of EMS implementation, Gene's Plating was removed from the Cal/EPA EMS Project. Gene's Plating was notified of their removal from the project by letter dated November 30, 2000.

Waste Water Treatment Facilities

Central Marin Sanitation Agency

The Central Marin Sanitation Agency (CMSA) is a public agency in Northern California that operates a regional wastewater treatment facility. CMSA treats sewage collected from San Rafael Sanitation District, Sanitary Districts No. 1 and No. 2 of Marin County, and San Quentin State Prison. CMSA is a medium-sized wastewater treatment facility with an average dry weather flow of 10 million gallons per day (MGD) and a 90-MGD peak wet weather flow. The facility is capable of handling up to 125 MGD. The facility currently employs 40 individuals to perform the daily maintenance, operation, and administrative tasks of the wastewater treatment facility.

CMSA agreed to implement an Environmental Management System (EMS) in an effort to improve the management of both the wastewater plant environmental aspects, as well as, the environmental aspects of the dischargers contributing to their flow, such as auto maintenance facilities. CMSA's operations primarily impact water-related media, however, air and land aspects are also affected, as well as other regulated and non-regulated issues. The EMS is being implemented to address all of these in a multi-media approach. CMSA's ultimate goal is to achieve ISO 14001 certification for their treatment plant as well.

CMSA has been in the unique position of spearheading an EMS program within the public-sector, wastewater treatment industry. CMSA is still in the early stages of EMS implementation and achieving their ISO 14001 Certification. Significant challenges encountered during the beginning of the EMS pilot project hindered some aspects of their progress, yet the desire to earn ISO 14001 Certification is still the objective, with a goal of late 2002. For the purposes of Cal/EPA research, CMSA's EMS is considered in the early design and implementation stage.

City of San Diego Metropolitan Wastewater Department, Operation and Maintenance Division

The City of San Diego Metropolitan Wastewater Department, a public agency, manages the resources to operate the Metropolitan sewerage system, which treats the wastewater generated by 15 area cities and districts. They serve 2 million customers generating approximately 200 million gallons of wastewater daily.

The O&M Division within the Metropolitan Wastewater Department operates and maintains several wastewater collection and treatment facilities, manages an operating budget of $70 million, and employs over 300 people. While the facilities are to some degree managed as well as regulated as separate entities, they are interconnected in that performance at one typically impacts performance at another.

The pilot project is classified as a recently implemented EMS for purposes of addressing the research questions. The O&M Division implemented an ISO 14001 EMS, certified in May of 1999 with scope expansions in October 2000 and February 2001. They achieved the distinction of becoming the first publicly owned treatment works in the U.S. to certify to the ISO 14001 EMS Standard.

International Business Machines

International Business Machines (IBM) creates, develops and manufactures advanced information technologies, including computer systems, software, networking systems, storage devices, and microelectronics. The company employs close to 290,000 people in over 140 nations. The pilot project participant is the San Jose Storage Technology Division site, which employs approximately 8,000 workers who develop, manufacture, and market storage components and systems. Manufactured products include thin film magnetic recording heads, thin film storage disks, and disk drive systems.

In 1992, the San Jose facility became certified to ISO 9001 (an international standard for product quality). In June 1997, as part of IBM's program to register all of its manufacturing and development sites worldwide, the San Jose Storage Technology Division site became the first IBM facility in the U.S. registered to ISO 14001. Because of its long history of environmental management programs, beginning with pollution prevention in the 1970's and its early certification to the ISO 14001 standard, IBM's EMS is considered fully implemented and mature.

Lockheed Martin Aeronautics Company - Palmdale

Lockheed Martin Aeronautics Company – Palmdale (LM Aero – Palmdale) is a leader in the design, development, systems integration, production, and support of advanced military aircraft. Rapid prototyping, simulation-based virtual design, and composite process development are just a few of the many engineering proficiencies that make this company preeminent in the aeronautics industry. The company's headquarters, which is also a major manufacturing operation, is located in Fort Worth, Texas with other major design and manufacturing sites in Marietta, Georgia, and Palmdale, California.

Lockheed Martin Aeronautics Company's site in Palmdale, California, is headquarters to the company's Advanced Development Programs (ADP), informally known as the "Skunk Works." It is also home to the U-2 high-altitude reconnaissance aircraft, upgrades and enhancements to the F-117 Nighthawk stealth attack aircraft, and C-130 special missions aircraft. It is located 80 miles north of Los Angeles in the Antelope Valley.

LM Aero – Palmdale marks 1992 as the beginning of their EMS; however, it was not until 1998 it was deemed compliant with the ISO 14001 EMS Standard. The EMS at LM Aero – Palmdale is considered fully implemented and mature. Certification to the ISO 14001 Standard may be pursued at some later date.

Pentel of America, Ltd.

Pentel of America is headquartered in Torrance, California. While there are offices in several states and a separate blister packaging facility in Torrance, all U.S. manufacturing is carried out at the Torrance factory. Operations include precision metal machining, plastic injection molding, water-base ink production, and writing instrument assembly and packaging. There are approximately 200 employees at the Torrance factory.

As a leading international manufacturer of writing instruments, stationary goods, and art supplies, Pentel Company, Ltd. has facilities located worldwide. Headquartered in Tokyo, Japan, the company employs a total international workforce of 2,100 employees. Products manufactured include automatic (mechanical) pencils, non-refillable roller ball pens, refillable ballpoint pens, gel ink pens, ink, lead, erasers, correction fluid,

highlighters, markers, crayons, water and oil paints, pastels, glue, and artist brushes. Pentel invented roller ball technology and pioneered graphite lead. In addition, Pentel is the only writing instrument company to receive the Deming Award for recognition of the highest standard of quality.

The pilot project is classified as a recently implemented EMS for purposes of addressing the research questions. Pentel began EMS development in October 1999, initiated the first cycle of its EMS in April 2001, and was certified to the ISO 14001 Standard at the end of August 2001. Pentel contributes the perspective and experience of working with a medium-sized manufacturing facility, which has integrated, to the degree possible, an ISO 14001 EMS with the previously existing ISO 9001 registered quality system.

Winery Project: Benziger Family Winery and Davis Bynum Winery

The EMS Winery Pilot Project involves two wineries in Sonoma County, Benziger Family Winery and Davis Bynum Winery. Both the grape growing and wine making operations are included in the pilot project.

The Benziger Family Winery is located on the East Side of Sonoma Mountain above the village of Glen Ellen, and is bordered by Jack London State Park to the west. The Benziger Family has operated their winery and vineyards at this location since purchasing the 85-acre Sonoma Mountain Ranch in 1980. Sixty-five acres of vines are planted at the ranch. Another twenty-acre parcel is planted with vines in nearby Sonoma Valley. Grapes are also purchased from more than 60 growers. The Benziger Family Winery produces 180,000 cases of ultra-premium wine per year. The winery employs 49 people full time and 29 people are either part time or seasonal workers.

Davis Bynum Winery was founded in 1973 as the first winery on Westside Road in the Russian River Valley. The vineyards include 22 planted acres of California Certified Organic Farming (CCOF) vines. Davis Bynum is a family operated winery that annually crushes 250-275 tons of grapes to make approximately 15,000 cases of ultra-premium wine. The winery and vineyard is primarily operated by three members of the Bynum family and a head winemaker. Davis Bynum also purchases grapes from neighboring growers. Nine people are employed full time at the winery while three are regular part time employees.

Although there is significant range in size between these two wineries they are both considered medium sized based on industry standards. Small wineries produce less than 5,000 cases of wine per year. More than half the wineries in California are small wineries. Twenty-five wineries in California are considered commercial wineries, each producing over 500,000 cases per year.

Benziger and Davis Bynum wineries are still in the design and implementation phase of their EMSs. They have cooperatively developed their EMSs with the assistance of

Cal/EPA. Work on their EMSs began in April 2000 and as of the date of this report they had developed environmental policies, significant aspects and set objectives and targets. They are still in the process of developing some implementation programs; however, they have begun making progress towards some objectives and targets.

VII. Project Findings

This section provides findings based on the results and analysis of the individual EMS pilot projects, separated into four categories. The first two categories address the main objectives of the Cal/EPA EMS project and are related to improved environmental protection and those related to greater public information. Improved environmental protection findings are discussed in relation to changes in awareness and commitment, systematic management of environmental impacts, and environmental performance. Findings relating to improvements in environmental information address public involvement in pilot project EMSs and public access to information. A third category addresses economic findings. The final category addresses lessons learned including challenges to and successes of EMS implementation.

A. Findings related to whether and how an EMS increases public health and environmental protection beyond that required by law and regulation.

Awareness and Commitment

- Environmental policies of pilot projects expressed commitments to the environment that went beyond simply meeting regulatory requirements. Each policy met the minimum ISO 14001 standards by committing to compliance, the prevention of pollution, and continual improvement. Many pilots expressed commitments to improve environmental protection in areas not addressed by law or regulation like resource conservation, waste reduction, transportation, and environmentally preferred purchasing. (IBM, Lockheed Martin Aero)
- The environmental policy provided a forum for companies to express company values, goals, and internal expectations of behavior and clearly communicate them to employees and the public. With a few exceptions, no formal communication of environmental policy was present prior to EMS implementation. (Wineries, Pentel)
- Knowledge and understanding of laws and regulations increased for many of the pilot projects. The increase was due to pilots completing procedures that identify, catalogue, and internally communicate all legal and other requirements. (CMSA, Pentel)
- Awareness of environmental impacts increased for pilot projects as a result of completing an environmental aspect and impact analysis. A comprehensive analysis of the environmental impacts of each organization was not available

prior to EMS implementation. Understanding of impacts increased for both regulated and unregulated impacts. General environmental management increased beyond regulatory requirements to include unregulated environmental issues as well. This can be attributed to the EMS emphasis that all aspects with significant environmental impacts, regulated and unregulated are managed. (Lockheed Martin Aero)

- The process of determining which environmental impacts were most significant increased each pilot's understanding of the relative importance of managing multiple environmental aspects. The significance determination allowed pilots to rank the importance of an impact and prioritize their response (all pilots).
- Pilot projects expressed commitment to environmental protection improvement through the setting of objectives and targets (Table 2). This type of goal setting for continual improvement of environmental protection was not present for most pilots prior to EMS implementation (San Diego, wineries, CMSA, Pentel, Artistic). A strong link exists between the significant aspects of a pilot and the objectives and targets they set. Pilots set objectives and targets in both regulated and unregulated areas; however, a few of the pilots focused on one area or the other. For example, San Diego, IBM and A-BI's objective and targets were almost exclusively in non-regulated areas. These pilots considered their regulated aspects as in compliance and sufficiently managed. Other pilot projects, Artistic Plating for example, largely focused their objectives and targets in regulated areas.

Systematic Management of Environmental Impacts

- The significance determination increased environmental protection by broadening the breadth of environmental management at the pilots to include all aspects with significant impacts and not just regulated ones. An identified significant impact either led to the setting of objectives and targets to reduce the impact, or to the establishment of programs or procedures to manage the impact to acceptable levels. The acceptable levels were either defined by regulation or by the pilot project at a level beyond regulatory requirements. Pilots often used operational controls and/or communication programs such as training, bulletin boards, and employee feedback to ensure the management of significant environmental impacts. (Artistic, IBM)
- Increased monitoring and measurement of environmental aspects were observed at some pilot projects. Often the amount of monitoring and measurement exceeded regulatory requirements or included aspects which did not require monitoring. Monitoring and metrics were also used to track progress towards objectives. (Pentel, Artistic)
- Improved systems for compliance assurance was observed at all pilot projects. These systems included some or all of the following elements:

improved monitoring, internal and external audits, management review, root cause analysis, corrective action, and preventive action. (Lockheed Martin Aero, San Diego, Anheuser Busch)

- EMS implementation often resulted in improved internal communication and employee understanding of job responsibilities and the environmental impacts of not performing jobs correctly. This was accomplished by tying training and other forms of information to elements of the EMS such as the environmental policy, significant aspects, objectives and targets and environmental performance. Examples of communication programs include environmental and safety committees, bulletin boards, and job hazard assessments. These changes helped establish new cultures of environmental awareness and responsibility on the part of employees and management. (Lockheed Martin Aero, Artistic)
- In some cases, employees' job responsibilities changed as a result of EMS implementation. Environmental responsibilities were written into job descriptions and environmental criteria were included in job appraisals. (Artistic)
- Most pilot projects created systems for continual improvement that included performance measurement, internal and external audits, management review, corrective action, and new objective setting. These elements of the EMS are dependent on good communication networks. These systems were more established in the pilots with more mature EMSs. (IBM, Anheuser Busch)
- Information technology played an important role in implementing, maintaining, and improving EMSs at the larger facilities with mature EMSs. Good information technology, such as internal web sites and email, appears to be critical for the implementation of complex EMSs at large facilities. Information technology may also help smaller organization implement EMSs. (IBM, Anheuser Busch)

Environmental Performance and Compliance

- Many pilot projects reported significant progress towards at least some of their objectives and targets (Table 2 in case studies). The process of setting and then working towards objectives and targets appears to greatly affect environmental performance. Several projects reported results significantly beyond their stated objective (Table 2: Artistic, Pentel, LM Aero, and San Diego). In one example at Pentel, several departments exceeded both electrical and solid waste reductions by several orders of magnitude over original targets.
- Some improvement in environmental performance was observed at all pilots reporting performance data (Table 3 in case studies). The range of improvement, however, varied between pilots with some reporting significant change (Artistic, LM Aero, Pentel, and San Diego) while others reported only

moderate gains (A-BI and IBM). Performance at the pilot projects also varied between different media (i.e. improvements observed in some media, while no improvements or reductions observed in other media).

- The vast majority of performance improvements were observed in non-regulated areas. With the exception of pollution prevention goals for hazardous waste and toxic releases, objectives and targets were more likely set for non-regulated media. Table 4 in the pilot study reports compares performance to permitted emission levels. In general, the pilots performed well below their permitted limits. However, with the exception of Artistic Plating, no pilot set performance objects beyond their mandated levels. Although Artistic's average emission rates for chromium and cyanide were below the permitted levels, they had at times exceeded the permit limits for those chemicals. Artistic, therefore, set targets to decrease chromium concentration by 10% percent and reduce cyanide to half their permitted level or 0.06 mg/l. Fifty-percent reductions were obtained for each of these chemicals. All other pilots with permitted emission levels simply set compliance maintenance as their EMS objective.
- Barriers or thresholds to environmental performance were observed in many pilot projects. As mentioned above, regulatory emission limits can act as a barrier to improved environmental performance. Reporting requirements can also establish a threshold of performance. At LM Aero – Palmdale, objectives were set to reduce toxic releases below Toxic Release Inventory (TRI) reporting requirements. Once this goal was reached, the objective was changed to maintain releases below the reporting requirements. Technical limitations can also act as a barrier and establish a threshold of performance. Hazardous waste generation at LM Aero – Palmdale has been reduced by 91% percent since 1991. Although LM Aero – Palmdale continues to reduce hazardous waste, gains are more difficult to obtain because of technical limitations. LM Aero – Palmdale now focus objectives on non- or less hazardous substitutes, hoping to find technical breakthroughs rather than incremental changes.
- It was difficult to observe compliance improvements, as measured by violations; however, many pilots had a better recognition of and response to compliance issues. (CMSA, Pentel, Artistic). In some cases, pilots who had no violations before the EMS was put in place, such as IBM, continued to have no violations afterwards. In other cases, pilots who had violations before the EMS, such as Artistic, had some violations after the EMS was put in place, but had better systems in place to respond to problems swiftly. In still other cases, the relatively minimal regulatory requirements to which some pilots were subject made it difficult to measure compliance improvements. (Wineries)

B. Findings related to whether and how an EMS provides greater environmental Information to the public than that required by law and regulation.

- New and useful environmental information can be created through the implementation of EMSs. This includes environmental policies, lists of significant impacts, objectives for improvement, and performance indicators. With the exception of some performance indicators, laws and regulations do not require this information be created.
- Through their participation with the Cal/EPA sponsored EMS Working Groups, pilot projects openly shared information about their EMSs with stakeholders. Shared information included environmental policies, significant aspects, objectives and targets, performance indicators, and some procedures. Interested businesses, non-government organizations, academics and government representatives participated in the Working Groups.
- For the most part, EMS implementation did not result in great improvements in the availability and access of environmental information to the general public. Pilot projects willingly shared information within the Working Groups; however, most only make this same information available to the general public upon request. LM Aero – Palmdale, ABI and IBM provide environmental information on their web sites. While LM Aero - Palmdale web site is specific to the Palmdale facility, IBM and ABI's web sites include information for their entire corporations. Several pilots post their environmental policy on the web.
- Direct government involvement through the Merit Partnership and Strategic Goals Programs improved the quality of the metal finishing EMS by helping to identify impacts and set meaningful objectives and targets. Cal/EPA's involvement in the development of the wineries' EMS also influenced their development.
- Local stakeholder groups were present at three pilots (CMSA, Wineries, and LM Aero – Palmdale). More focused stakeholder participation and input into EMSs occurred in Local Working Groups as compared to the Regional Working Groups. Local groups were able to learn more details about the pilot's EMS and have greater opportunity to affect EMS development. Local groups also included stakeholders who were more likely to be directly affected by the pilot's activities. These stakeholders included local regulators and community activists.

C. Economic Indicators

- Only two pilot projects reported economic data. As a result of environmental improvements in its manufacturing processes, Artistic Plating is projected to realize a $1,028,960 saving over a 10-year period. LM Aero – Palmdale has

reduced its annual environmental costs by over $1 million (or 54%) between 1992 and 1999. Total cost savings during that period equal $7,249,000.

- Although economic data may not be generally available, several pilots reported cost savings as a result of EMS implementation (Pentel, San Diego, IBM, and A-BI).

D. Challenges to and Successes of EMS implementation

- The presence of a champion appears critical for successful development and implementation of an EMS. A champion is someone who strongly believes in the benefit of an EMS and will work hard to ensure that one is implemented. Champions were observed in each of the pilots that were in the early stage of development and implementation. CMSA lost some of its momentum towards EMS implementation when their champion was reassigned to other duties.
- Senior management support is another critical element for successful EMS implementation. Management must be involved and/or provide human and economic resources necessary to complete EMS development and implementation. Based on competing priorities, CMSA management had recommended to its board of directors that it authorize a slowdown of EMS implementation. Several people spoke against this idea at a board meeting, including Local Working Group members, and the board overruled management, and required that EMS implementation continue as planned.
- Maintaining focus and momentum is a challenge for small and medium sized enterprises (SMEs). Because employees and management at SMEs are often responsible for several jobs, people involved in the EMS must successfully balance EMS work with other duties.
- The significant economic and human resources needed to develop, implement, and maintain an EMS are a challenge to SMEs. Another challenge is the technical complexity of EMSs. The costs for technical consultants may be a barrier for EMS implementation at SMEs.
- Technical assistance from government helped overcome economic and technical barriers to EMS implementation at the pilots considered SMEs (Artistic, Davis Bynum Winery, and Benziger Family Winery). Artistic Plating greatly benefited from the Metal Finishing EMS Template and training workshops funded by US EPA. Cal/EPA provided technical assistance to Davis Bynum and Benziger wineries for their EMS development. This work also produced an EMS template for wineries. In addition, Cal/EPA provided EMS training for CMSA, through a US EPA grant. Cal/EPA organized four educational workshops for pilots and stakeholders participating on the Working Groups through US EPA grant money.

- Developing templates and working with industry associations can have the potential to leverage whole business sectors, as in the case of the metal finishing industry and the wineries. Templates can help facilitate learning on a much larger scale by identifying industry specific aspects and impacts, as well as compliance requirements, for example. Industry associations can help support the introduction of EMSs in their sector, and provide financial support as well.
- Pilots with fully implemented EMSs, like LM Aero – Palmdale, IBM, ABI, Pentel and San Diego were able to successfully connect the different elements of their EMS (policy, aspects, objectives, programs, communication, measurement, review, corrective action, and continual improvement) into a consistent and integrated system that works to implement the environmental policy of the organization. This means for example that identified aspects are consistent with the scope of the EMS as defined in the policy. Objectives and programs are designed to manage or minimize impacts of significant aspects. Personnel are properly trained in order to minimize impacts and achieve objectives. Management of significant aspects are measured and audited with respect to legal and other requirements. Performance towards objectives is measured. Management reviews performance and audit reports and directs corrective action to address deficiencies. Environmental protection is continually improved through system adjustments and the achievement and resetting of objectives. These pilots were able to achieve this integration through effective communication networks.

  On the contrary, pilots with EMS still in development or partially implemented like CMSA, Davis Bynum and Benziger have not been able to thoroughly connect various elements of their EMS. CMSA, Davis Bynum and Benziger have yet to develop programs to meet objectives, monitor progress, audit results, review performance and make corrections to their systems. Limited performance improvements are observed at those pilots. Although Artistic has implemented their EMS and has seen positive performance results, some compliance issues observed at Artistic are in part attributed to production pressures and a lack of adequate operational controls. Operational controls were not included in the Metal Finishing EMS Template used by Artistic in creating their EMS. Operational controls appear an important part of a fully implemented and integrated system. Also, system audits have not yet been conducted at Artistic.
- Pilots with mature EMSs were also able to integrate their EMS into the various aspects of their business including design, production, management, purchasing, human resources, etc. This integration was observed in pilots with a broad EMS scope, meaning the EMS addressed most or all of the pilot's business functions. Integration was accomplished by identifying significant aspects in many business functions and establishing objectives or

programs to manage those aspects. Especially effective were programs that incorporated several environmental and/or health and safety issues in meeting EMS objectives.

VIII. Analysis

This analysis section is based on the findings presented in the previous section and provides a synthesis of that information in order to understand how an EMS can provide improved environmental protection.

The Value of a Systems Approach

The Cal/EPA EMS Pilot Project has found that EMS implementation can have a positive effect on environmental protection, including improved systems for environmental compliance. How this is accomplished can also be understood through the findings related to changes in *awareness and commitment* and *systematic management of environmental impacts.* These findings addressed changes in the fundamental system of environmental management at the pilot project. The findings suggest that the systematic nature of their EMS, or the systems approach to environmental management used in their EMS is key to this success.

An accepted definition of a system is "*a set of elements in dynamic interaction, organized for a common goal.* " The Plan-Do-Check-Act (or Adjust) cycle broadly outlines the systems approach of an EMSs. This cycle establishes a feedback loop that helps drive continual improvement in environmental protection. Missing, however, from this broad outline are the important structural elements of an EMS that act to integrate the environmental goals of an organization into its business functions. The structural elements include the technologies, programs, procedures, personnel, and communication networks of the organization.

There are several elements found in a well-functioning EMS that illustrates its systems approach to environmental management and how they can affect environmental protection. These are:

a) Planning

i) Articulating an Environmental Policy that establishes the commitments or goals of the organization.

ii) Reviewing the whole system or all the interactions of the organization to determine which have impacts on the environment and analyzing those impacts to determine which are most significant, thus improving awareness.

iii) Establishing objectives for environmental improvements based on known environmental impacts. These set commitments for improved protection.

b) Doing

i) Implementing programs, such as operational controls, that support the environmental policy, limit significant impacts, and work to meet objectives. These programs grow out of commitments made by the organization and are based on awareness and understanding of their impacts.

ii) Communicating to members of the organization the importance of adhering to the environmental policy, the environmental impacts of their jobs, and ways to perform one's job in a way consistent with the environmental policy. Communication increases awareness and establishes the organization's and individual responsibility, or commitment for environmental protection.

c) Checking

i) Creating metrics for the measurement of environmental performance towards objectives. These indicators of performance also increase awareness and provide important feedback on the performance of the system.

ii) Auditing practices and performance to ensure adherence to the environmental policy and progress towards objectives. Auditing provides another important feedback element on how well the system performs.

iii) Top management reviewing environmental performance and practices. This feedback process ensures that those in charge of the organization are aware of the ability of the system to provide the level of environmental protection to which the organization has committed.

d) Acting/Adjusting

i) Making changes in the system to ensure continual improvement in environmental protection. This feedback process can affect any part of the system that requires improvement.

Factors That Affect the Quality of an EMS

A range of environmental performance outcomes, or protection improvements, was observed in the EMS pilot projects. Cal/EPA observed several factors that either act to inhibit or promote successful EMS implementation as measured by the resulting improvements in environmental protection. Inhibitors can also be thought of as barriers. Some of these factors come from the findings on Challenges and Successes of EMS Implementation; others are distilled from various different sections. With this knowledge, Cal/EPA may be able to better evaluate EMSs and recognize weaknesses, help educate organizations on successful EMS implementation, and create systems for better environmental protection.

Table 4
Promoters and Inhibitors of EMS Implementation

Promoters	Inhibitors
Strong management commitment to EMS implementation and improved	Weak management support of EMS implementation and acceptance of status

environmental protection.	quo in environmental protection.
The presence of champions, in either management or staff.	Apathy or resistance to EMS implementation in management or staff.
Financial and personnel resources to develop and implement an EMS.	Lack of financial or personnel resources to develop and implement an EMS.
Involvement of personnel from all parts of the organization in EMS development.	Few personnel involved in EMS development.
Broad scope in the evaluation of environmental impacts.	Narrow scope in the evaluation of environmental impacts.
Stretch goals for improved environmental protection.	Minimal goals for improved environmental protection.
Use of communication tools as feedback mechanisms to inform members of requirements, report performance, and implement system adjustments.	Incomplete feedback mechanisms due to poor communication systems.
Technical expertise either in house or from outside consultants.	Lack of technical expertise.
Availability of tools (training, templates, and guidelines) to assist in EMS development and implementation.	Absence of tools to assist in EMS development and implementation.
Involvement of outside stakeholders either from the government, other businesses (industry associations), or the community.	Isolated development and implementation of the EMS.
Determination to break through limits to environmental improvements through technical, economic, or cultural change.	Limits to environmental improvements resulting from technical, economic, or cultural factors.

Improvements in Environmental Protection

Findings on Environmental Performance and Compliance as well as the findings on Challenges and Successes of EMS Implementation support the following analysis. This analysis seeks to illustrate the potential for changes in environmental protection as a result of EMS implementation.

Although the amount of improved environmental protection observed in the pilot projects varied, each pilot project demonstrated some level of improvement over pre-EMS conditions and over their regulatory requirements. The causes of these variations can be attributed to the various factors described above, which either act to promote or inhibit successful EMS implementation.

Theoretically, improvement in environmental protection can be graphically represented by an ‘S’ curve (Figure 3). The graphic below can represent either overall improvements of an organization, or specific improvements in a single media or indicator such as

water use. During the early stages of EMS development and implementation, an organization must overcome challenges that act to inhibit the system's development and impact the resulting level of environmental protection. As these challenges are overcome and the system is implemented, environmental protection advances. Improvements will continue until barriers for continued improvement, or thresholds of the system are reached.

Barriers are system inhibitors that act to limit continued performance improvements. Several types of barriers may act to stabilize environmental improvements. Barriers may be technical or economic in nature, for example the absence of an acceptable substitute for a hazardous material. Barriers may also be socially created such as setting goals based on acceptable regulatory emissions levels, or the achievement of goals without further goal setting. Some organizations may choose to move on to other environmental issues once an objective for a particular impact is reached or diminishing returns are indicated. In order for environmental improvement to continue the system must be adjusted in order to breakthrough the barrier and establish a new period of continual improvement (Figure 4).

A third scenario is that environmental performance may actually backslide once a barrier is met. Backsliding may indicate major problems in the operation of an EMS. Changes in personnel, direction of an organization, or neglect can cause performance to backslide (Figure 5).

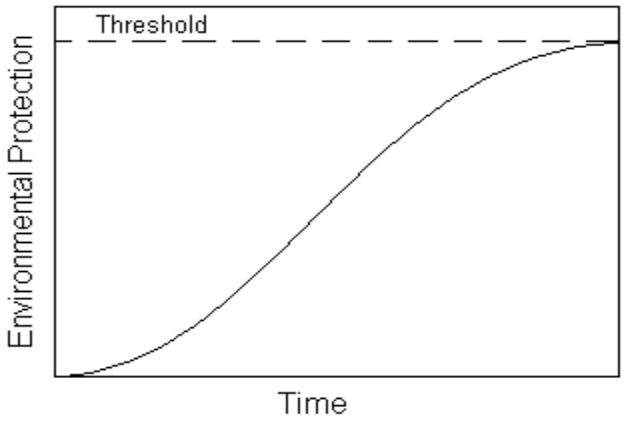

Figure 3: Continual Improvement with Single Barrier and Performance Threshold

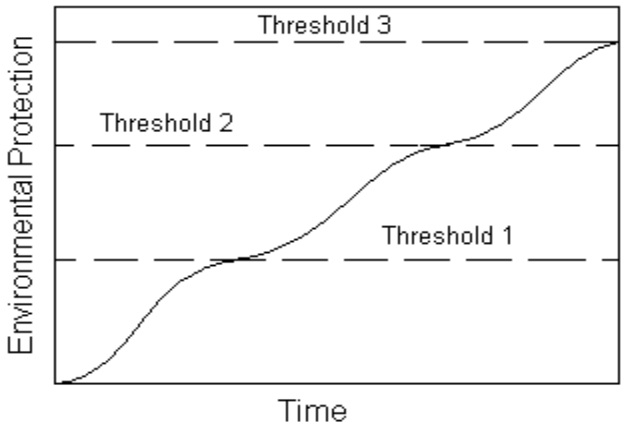

Figure 4: Cycles of Thresholds and Breakthroughs

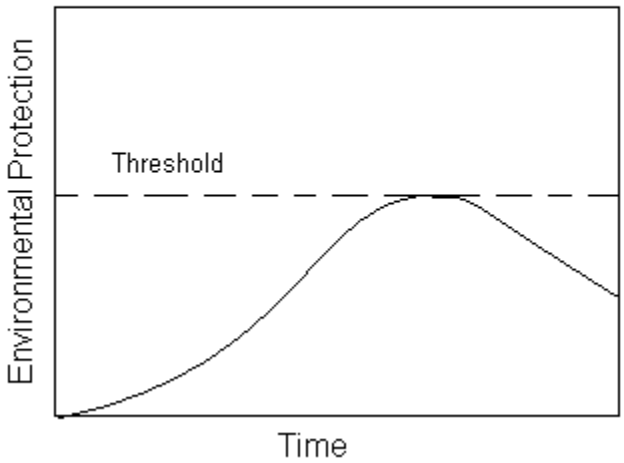

Figure 5: Performance Backsliding

The above graphs help identify periods in EMS development where assistance or intervention may help overcome barriers to environmental improvement. Several barriers or inhibitors are at work during the initial phase of EMS development. Interested stakeholders such as government agencies, communities, academics, or others in industry may play a role to help overcome these barriers by providing technical or financial assistance, or other motivations. At the other end of the curve inhibitors that limit environmental improvement may also be targeted to help achieve breakthroughs that result in another continual improvement cycle. The graph illustrates that leverage

points exist at the two opposite ends of the continual improvement cycle. Leverage points exist at the beginning when early challenges to system development must be overcome and at the end of the cycle when the limits act to slow or stabilize improvement. The possibility of performance backsliding indicates that monitoring, maintenance and vigilance is required for any EMS.

IX. Conclusions

1. EMS Can Have a Positive Impact on Environmental Protection

One objective of this study was to answer whether an EMS can provide greater environmental protection than the regulatory systems. The answer to this question is yes, in that as a result of EMS implementation, most pilot projects improved environmental protection in areas of significant environmental impact that are not addressed by regulation or law. The Cal/EPA EMS Pilot Project has demonstrated that EMSs can have a positive impact on environmental protection. Environmental protection at most of the pilots improved after implementing an EMSs. EMS implementation also assisted in reducing hazardous waste *generation*, which, unlike hazardous *waste* is not regulated,.

Very few pilots, on the other hand, outperformed legally mandated performance levels, such as discharge limits, as a result of EMS implementation. EMSs were also responsible for improved compliance with regulatory standards at pilots such as LM Aero - Palmdale and Pentel.

Improvements were observed in each of the three sets of indicators of improved environmental protection measured in the pilot project: awareness and commitment, systematic management of environmental impacts, and performance of key environmental indicators. As understanding of environmental impacts increased, the commitment to environmental protection expanded to include non-regulated activities. Better systems for environmental protection emerged from EMS implementation including operational controls, training, communication, audits, management review, and corrective action. Environmental performance improvements were especially seen in non-regulated activities like energy and water conservation, waste reduction, and pollution prevention.

2. A Systems Approach Towards Environmental Management Can Yield Positive Results

Part of the primary objective of the EMS pilot project was to determine how an EMS improves environmental protection. EMSs can improve environmental protection at an organization by taking a Systems Approach. A system is defined as a set of elements in dynamic interaction, organized for a common goal. A properly implemented EMS meets this definition. Critical to the operation of a system and the achievement of goals

is the movement of information through feedback loops. Feedback and corrective action can result in the continual improvement of environmental protection.

3. Some Organizations May be Reluctant to Set Objectives and Targets that Exceed Regulatory Standards

Quantitative regulatory emission and discharge standards can act as a ceiling for environmental performance if an organization is not motivated to perform beyond regulatory requirements by other benefits, economic or civic. Reporting requirements can also act as a barrier for improved performance. Once a reporting threshold is surpassed, i.e., reporting is no longer mandated, motivation for further improvements can diminish.

The potential for compliance standards acting as a ceiling for environmental performance may be attributed to several factors, including:

- Unwillingness to expend capital to perform beyond legal requirements.
- Concern that if an organization demonstrates performance below regulatory levels, those regulations may change and require a more stringent level of performance.
- An acceptance of regulatory compliance as adequate management in meeting the ISO 14001 requirement for establishing operational control over all significant aspects.
- A belief that an environmental impact of an activity is not significant if that activity is operating within regulatory standards.

4. Economic Benefits May Motivate Improvements in Non-Regulated Activities

Although limited economic information was collected in the EMS Pilot Project, several pilots reported significant economic savings from improved environmental protection. Economic benefits were realized from the conservation of electricity and water and the reduction of solid and hazardous waste disposed. The economic savings allowed pilots to invest in environmental programs and technology. Economic benefits can provide incentives for organizations to invest in greater environmental protection.

5. Better Understanding of EMS is Needed at All Levels of Government

Since environmental performance can be enhanced through the use of EMS, government at all levels will need to understand EMSs and their use as a tool to better environmental performance. Thus, more education about EMSs is necessary in the regulating sector.

Another advantage of EMSs for the regulating community is that EMSs could facilitate more efficient and organized inspections because the EMS standards for

documentation (i.e., training records) relate to many environmental inspection requirements.

6. EMSs Generate New and Useful Environmental Information

The systems approach to environmental management found in EMS generates new and useful information. In order to manage the environmental responsibilities systematically, an organization must create information, translate that information into knowledge and knowledge into action. This information flow acts as a feedback loop allowing the system to adjust in order to stay consistent with the environmental policy and meet objectives. The types of information created by an EMS include:

- Environmental Policy: establishes the vision, commitments and goals of the organization
- Significant Environmental Aspects and Impacts: identifies the serious impacts an organization has on the environment
- Objectives and Targets: sets a course of action for minimizing or eliminating environmental impacts
- Performance Metrics: measures progress towards objectives
- Programs and Procedures: defines practices of the organization that control activities which have an impact on the environment
- Audit Results: reports on the effectiveness of the organization in meeting the environmental policy, objectives and targets, and defined procedures
- Preventative and Corrective Action: adjustments made in the system to ensure the implementation of the environmental policy

7. Potential for Improved Sharing of Environmental Information with the General Public not yet Realized

A second objective of the Cal/EPA EMS Pilot Project was to determine whether an EMS provides the public with greater environmental information than provided by the regulatory systems.

Environmental information generated by a pilot's EMS is usually organized in ways that make the information relevant and accessible. However, this information is generally used for internal purposes or made available to the public only on request. With the exception of the Cal/EPA sponsored stakeholder Working Groups, environmental information generated by the pilots was not generally shared with the general public. Several pilot projects use the Internet to provide the public with some environmental information.

8. EMS Information May Be Useful to External Parties and Help Improve Environmental Protection by Creating External Feedback Loops

The type of information generated by EMSs may be valuable to both environmental agencies and communities. Information on environmental impacts, plans for environmental improvements, and data on progress towards objectives may be of interest to outside stakeholders. Governments might use this information to support voluntary programs. Communities or non-governmental organizations could use the information to track environmental issues important to them and provide feedback to both regulatory agencies and to the organization with the EMS. Therefore, EMSs have the potential of establishing performance enhancing communication systems between industry, communities, and government.

EMS generated information may help to improve environmental protection through the establishment of communication links with outside parties. Internally, information is used within the Plan-Do-Check-Act feedback loop to stimulate continual improvement. Much of this same information might flow though external feedback loops with outside public and government stakeholders. More open and transparent EMSs could result in external feedback loops where an organization shares environmental information such as policy, impacts, objectives, and performance with outside stakeholders. These stakeholders can, in turn, provide feedback on whether the EMS considers or meets stakeholder goals, objectives or needs. As a result, organizations with EMSs may become better informed on the environmental issues of stakeholders affected by their operations. Without this information, EMS may be developed and implemented without considering important environmental concerns of the community, government agencies, industry organizations, non-government organizations, or other stakeholders.

There are five elements of an EMS that may be of interest to outside parties and are critical for informed stakeholder feedback. Each of these elements provides information about the environmental values, impact and performance of an organization. The five elements are:

1. Environmental Policy
2. Impact Identification
3. Significance Determination
4. Objective Setting
5. Performance Indicators

9. Small and Medium Sized Enterprises (SMEs) May be Especially Challenged in Implementing EMSs

For a small or medium sized enterprise, there are many barriers to successful EMS implementation. These companies may face personnel and economic challenges in EMS implementation that are not issues for larger companies. SME may require assistance in overcoming barriers. Large, sophisticated organization could play a role in mentoring smaller organizations. Supply chains could provide a framework for this mentoring.

10. Government Support of EMS Could Improve Environmental Protection and Information

As the protector of the public good, government has a special role in supporting EMS development. Government's interest in supporting EMS should be based on a desire to improve environmental protection and information to the public. This report has concluded that EMSs can have a positive effect on environmental protection; therefore, EMSs should be viewed as a viable and potential tool for increasing environmental protection. Below are some of the ways government can support EMS development and improve environmental protection.

- Provide tools such as templates or EMS implementation guides.
- Provide grants for the development of tools for a particular industrial sector.
- Establish partnerships between industry, government and community stakeholders in order to increase the flow of information about environmental impacts and protection.
- Establish goals for regulated and non-regulated environmental impacts. Either voluntary or mandatory, these goals could influence EMS objective setting.
- Reward companies operating in excess of regulatory standards. Rewards such as public recognition could be based on the implementation of an EMS, compliance with environmental laws, the sharing of environmental information, and progress towards government-accepted goals, or achievement of government-accepted goals.
- Provide resources to help organizations break through barriers that may limit environmental improvement.
- Support EMS development as a Supplemental Environmental Project in enforcement cases.
- Establish standard public reporting guidelines similar to the Global Reporting Initiative.
- Include increased public reporting in environmental recognition programs.

11. EMS Require a Foundation of Enforceable Standards

EMSs should not be viewed as an alternative or a replacement for the current command and control regulatory system. Enforceable standards are essential to environmental protection in California because they set the minimum level of performance. EMSs provide a new tool that can help ensure greater adherence to regulatory standards as well as protection beyond legal mandates and in areas outside regulatory protection.

X. Recommendations

1. Establish and Nurture a Culture of Innovation and Experimentation within Cal/EPA

Cal/EPA can help to institutionalize the use of cross-media, multiple tool approaches to address persistent California-specific environmental problems. This can be accomplished through specific projects implemented through partnerships involving state, local, and federal agencies as well as industry representative and the non-government public interest sector.

Through implementing its own EMS, Cal/EPA can also learn about EMSs and set an example for others This first hand experience with EMS implementation will help Cal/EPA understand the application of an EMS more thoroughly, and learn how it applies to a regulating agency.

Also, Cal/EPA can develop emerging leaders by informing and educating Cal/EPA management and professional staff about the range of policy, management, and technology tools available for environmental problem solving. This approach can help federal, state, and local governments develop the leadership ability to institutionalize more protective environmental and resource management policies and practices through education and practical application.

2. Government can set targets to increase environmental performance

Government can establish environmental improvement targets for those sectors contributing to specific environmental problems. Targets can be set sector-wide and can be voluntary in nature, or legislatively mandated.

To demonstrate how this can be accomplished, government could target specific industry sectors, and look for ways to partner through EMS and other innovation tools. Government has a role in developing templates and working with industry associations. This action has the potential to leverage whole business sectors and reduce environmental impacts across an entire industry, as in the case of the metal finishing industry and the wineries.

3. Government can support environmental information sharing with the public and recognize efforts to share information

EMSs provide an excellent structure for gathering information. Government can help make environmental information available to the public, such as information on environmental impacts, plans for environmental improvement, and data on progress towards meeting objectives. For instance, government could encourage organizations to generate meaningful viable environmental improvements and information for the public, and to recognize efforts in an effective manner.

Government could explore the possibility of developing a reporting approach for organizations with EMSs, which meet multiple agency requirements in a consolidated

fashion. In this way, government may be able to request more environmental performance data, recognize accomplishments, and make reporting requirements more efficient.

4. Establish a Regulatory Track for High Environmental Performers

In order to maintain and increase environmental protection for the highest environmental performing organizations, a separate regulatory track should be created. In exchange for strict environmental compliance and superior environmental performance and increased public reporting, advanced legal relationships between the regulated and regulating agencies can be established. This, new approach could include facility wide permits, longer permit life, and more meaningful and modern reporting requirements.

5. Implement EMSs with Key Elements

For an organization to successfully implement systems based management of the environment, key elements must be present. Based on the information collected in the pilot project, Cal/EPA recommends the following key elements:

- An environmental policy with commitments to pollution prevention, resource conservation, compliance, public involvement and continual improvement;
- Whole system assessment of environmental impacts and identification of those which are most significant;
- Objective setting for the reduction of environmental impacts;
- Measuring and monitoring of practices and performance which support environmental policy and objectives;
- Operational controls;
- Audits (internal and third party);
- Management review and adjustments in the system to ensure continual improvement;
- Involvement of effective stakeholders; and
- Public reporting of performance results.

Appendices

Appendix A: Anheuser Busch, Inc. Fairfield Facility Pilot Study Report
Appendix B: Artistic Plating Pilot Study Report
Appendix C: Central Marin Sanitation Agency Pilot Study Report
Appendix D: San Diego MWWD, O &M Division Pilot Study Report
Appendix E: IBM Pilot Study Report
Appendix F: LM Aero – Palmdale Pilot Study Report
Appendix G: Pentel of America Pilot Study Report

Appendix H: Wineries Davis Bynum and Benziger Family Pilot Study Report
Appendix I: Pilot Projects' Environmental Policies
Appendix J: Public Resource Code 71045(Assembly Bill 1102)